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PILOT STUDY

TUSCARORA MOUNTAIN SOIL SURVEY

REPORT OF FINDINGS

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DEPARTMENT OF THE INTERIOR
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FOREWORD

The "Tuscarora Mountain Survey" is a cooperative study by the Bureau of Land Management and the Soil Conservation Service. Bureau of Land Management participation was directed toward analyzing SCS procedures for inventorying soil and vegetation simultaneously and determining their usefulness in BLM management activities.

The writers participated in the cooperative survey, as the Bureau of Land Management respresentatives.

The following report has been prepared on the basis of observation, study, and participation in the survey for the period from September 1961 to January 1964.

Elwin H. Price
Range Manager

Charles W. Luscher
Range Conservationist

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I. INTRODUCTION

Nature and Purpose of the Study

The Tuscarora Mountain Survey was conducted as a cooperative survey by the Soil Conservation Service and the Bureau of Land Management. The primary purpose of Bureau of Land Management participation was to study the Soil Conservation Service procedures for inventorying both soil and range with information on the soils and vegetation being obtained simultaneously in the field and a determination and analysis made as to their correlation and relationships, and the feasibility of Bureau of Land Management procedures (range resource inventories, condition and trend studies, etc.) being modified to include soil survey information, range site classification, etc.

The survey plans called for two intensities of soil surveys. A low intensity detailed standard soil survey on the rangelands and a high intensity detailed standard soil survey on all the irrigable lands, which comprise approximately 5 percent of the area and on present rangelands which may have irrigation possibilities. Bureau of Land Management participation was directed primarily toward the low intensity portions of the survey.

The Soil Conservation Service procedures are designed in an effort to complete their responsibilities for providing standard

soil surveys on all lands within the United States, including publication of the surveys, and at the same time reflect information suitable for range management and ranch planning that can be carried out at the same time the soil mapping is being done.

The stated purpose of the soil survey is to supply basic resource information to ranchers, farmers, engineers, land developers, resource managers, etc., as well as specialists interested in various aspects of resource conservation.

General Description of the Study Area

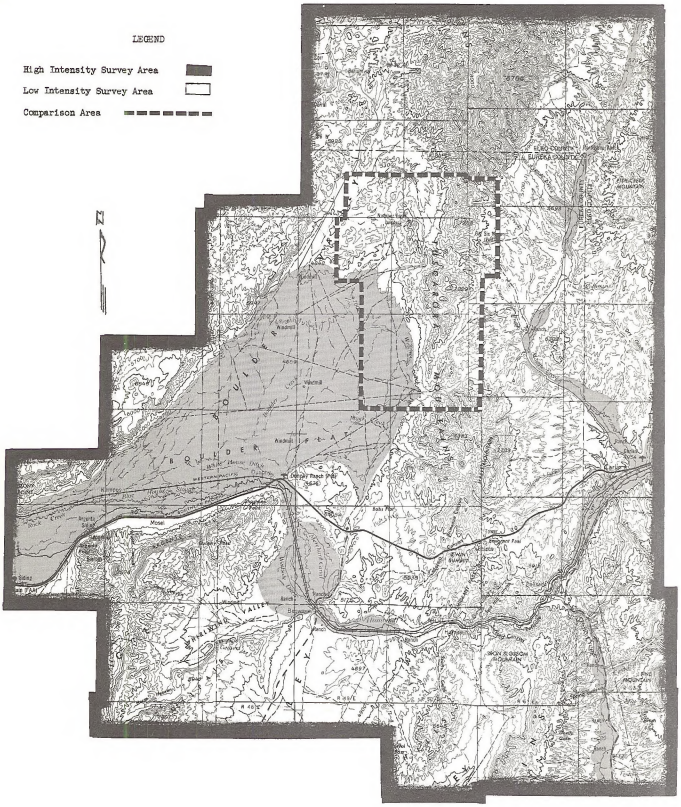
The Tuscarora Mountain survey area encompasses some 980,000 acres, of which approximately 95 percent is used for livestock and wildlife grazing. Approximately two-thirds of the land area is privately owned (once being largely checkerboard railroad land), the remainder being public lands administered by the Bureau of Land Management.

The area lies in the northernmost portion of the Great Basin, which constitutes most of the State of Nevada, and is a mountainous upland area with intervening valleys, located in Elko, Eureka, and Lander Counties. Important physiographic units located within the area include portions of the Tuscarora, Independence, Cortez, and Shoshone Mountains, Boulder Valley and floodplains along the Humboldt River and its tributaries.

Elevations within the area vary from about 4,500 feet along the lower floodplains of the Humboldt River to over 8,500 feet in the mountain ranges. The climate of the area is generally referred to as semiarid continental, characterized by cold winters and warm summers, with a range in precipitation from a little over 6 inches per year in the southern portion of the area to an estimated 24+ inches in the higher mountains. The growing season ranges from mountain areas where frost occurs every month of the year, to 115 days in the valleys. An estimated 50 to 80 percent of the precipitation falls during the winter and spring months.

The soils of the area are generally as diverse as the topography and cover a relatively wide range and variety of parent materials. Alluvium laid down in ancient lakes and seas provided parent material for many soils; others have formed from volcanic activity, and still others have developed from loessial material.

The broad range of physiographic and climatic factors affecting this area results in a very diverse association of plants and plant communities.


LEGEND
High Intensity Survey Area
Low Intensity Survey Area
Comparison Area
N
ELKO COUNTY
EUREKA COUNTY
Elko
Carlin
Beaver Peak Pass
Mosier
Pass
Emigrant Pass
Pass
Pass

II. METHODS AND PROCEDURES EMPLOYED

The following procedures are outlined on the basis of their use and interpretation by the Soil Conservation Service. Bureau of Land Management representatives did not attempt to modify or revise these procedures in any way.

Soil Survey Procedures

Two separate intensities of soil surveys were employed in this study for the reasons that they are normally made in detail consistent with the information required; thus rangelands were completed with low intensity detailed standard surveys, and those lands presently being cultivated or having an irrigable potential were completed with high intensity detailed standard surveys. The basic objectives of the two intensities are the same, although the number of soil mapping units, their composition, and the degree of cartographic detail vary with the complexity of the soil patterns and the needs of the users.

A standard soil survey is one in which the soil mapping units have been defined in terms of the nationwide system of soil classification and meet the requirements of the National Cooperative Soil Survey. Surveys are detailed in the sense that the boundaries of mapping units are observed throughout their courses, either in the field of from aerial photos, and the soils in each area delineated are actually examined in the field by

the mapper. The intensity of detailed standard soil surveys may be further classified into three groups: high, medium and low intensity.

A low intensity survey is one in which the mapping units are dominantly phases or combinations of soil types or soil series (i.e., soil associations or undifferentiated soil groups), and where significant differences may be accurately mapped by examining the soils at moderate to wide intervals.

A medium intensity survey is one in which the mapping units are dominantly phases of soil types, usually somewhat more broadly defined than for high intensity surveys, and where significant differences may be detected and mapped accurately by examination at moderate intervals.

A high intensity survey is one in which the mapping units are dominantly narrowly defined phases of soil types and where the soils must be examined in detail at close intervals in order to detect differences significant to use and treatment. These are generally croplands presently in production or areas susceptible to cultivation where more intensive treatment of the soil is made or anticipated.

Soil survey activities include mapping, classification, correlation, interpretation, map compilation, publication, and investigation of soil genesis, morphology, and classification where necessary.

The first step in a soil survey, exclusive of planning, is to prepare a descriptive or mapping legend for the particular geographic area. There are three minimum requirements of a descriptive legend: (1) The identification legend of mapping units and symbols by which they are identified, (2) a description of each mapping unit (soil series, type or phase (illustration #1)), and (3) a table showing the characteristics and genetic relationships of each of the units. Since the lines on soil maps or photographs represent boundaries between significantly different kinds of soils, and the symbols placed within the soil lines describe the soil type, slope, and erosion phase, it is necessary to develop and maintain a usable and current record or legend of the symbols. The legend, descriptions, and tables are available to all mappers and users of the maps during the survey. As new mapping units are encountered during the survey, they are added to the legend.

The State soil scientist, a soil correlator, members of the survey party, and any others deemed necessary, conduct an initial field review of the survey area and prepare a preliminary classification legend. This is merely a preliminary field study of the

soils in the area to be covered by the soil survey. The legend and report of the initial review are very important as they will be the chief guide for conducting the survey. At this time, the soils known to occur in the area are listed and described, symbols are assigned to each soil mapping unit, plans for collection of data for soil interpretations are made, descriptive legends are started, and any other preliminary investigations or data required are initiated. After the initial review is completed, the actual soil mapping begins. By field investigation, the survey party studies and plots the boundaries of soil mapping units on aerial photographs along with the symbols to describe the kinds of soils. Several basic properties are assessed and integrated into a mapping unit, the more important of which follow: relationship of landscape, climate, parent material, relief, vegetation to the soil, soil profiles, slope, erosion, stoniness, soil acidity or alkalinity, and drainage. Field sheets are normally prepared at each site examined and indicate the important characteristics.

During the entire course of the field mapping, data are assembled to aid in the ultimate interpretations. This includes information on forage yield, treatments, alternate uses, and potentialities and limitations of the soil.

Throughout the course of the survey, periodic reviews are made of the field work, including mapping, descriptive legends, photographs, soil handbook, interpretation data and groupings, and any other phases of the survey deemed necessary. The primary function of the review is to give technical guidance and check on the technical accuracy of the work. These reviews are made by the same personnel who made the initial review.

Mapping is then completed, making the necessary corrections and revisions noted by the progress reviews. Upon completion of the mapping and documentation of all materials, a final review and field correlation is made by the review personnel. A final check is made on accuracy and completion of field work and recommendations made for correlation of all mapping units.

After the aerial photographs are checked for errors and final inking is completed, they are sent to the cartographic section for copying and acreage measurements and then returned to the field office.

At the conclusion of the final review all materials are made available to the principal soil correlator for the area involved, who makes an intermediate correlation in which he assigns names to the soils and insures uniformity in classification of soils in his group of States. Final correlation is made by the Director of Soil Classification and Correlation in Washington, D. C.

to maintain a nationwide uniformity in soil classification and nomenclature (to extend information obtained on one soil to like soils in other areas requires that these soils be given names, thus insuring classification consistency and fitting them into the nationwide system of soil classification).

The ultimate goal of the survey is the preparation of the soil survey report manuscript. The soil handbook prepared during the course of the survey is used for the basic material. The report makes the findings of the soil survey available for use. The report describes each soil, summarizes what is known about them, and explains their potential uses.

After all aerial photos are checked and inking is completed, they are sent to cartographic where a mosaic map is prepared from them. The completed maps made from the aerial photos are complete soils maps of the area and, along with the published soil report, are the final product.

Range Site Procedures

Range site classification, as employed by the Soil Conservation Service, is a system of appraising the resources of rangelands and developing information useful in their management. Range sites are, therefore, distinctive kinds of rangeland with different potentials for producing native plants. Each range site has its own combination of environmental conditions which

produces a characteristic plant community. A range site is also a specific area of land whose characteristic features can be recognized and described and which retains its ability to reproduce this potential plant community unless materially altered by physical deterioration.

Distinctions between range sites are recognized by differences in the kinds or proportions of plants that compose the potential plant community (potential as interpreted by the SCS is synonymous with climax) and differences in the total production of vegetation when the composition of the potential plant community is essentially the same. These differences must be great enough to require some change or variation in management. Range sites <u>are not</u> determined by differences in soil or climate unless they result in differences in the potential plant community.

In determining the potential plant community for a range site, several methods are utilized, although the evidence from any one separately is generally not conclusive. Following are the primary items considered when setting up the characteristic grouping of species which determine a range site:

1. Evaluation of relic vegetation on the same or similar soils (either protected or relatively undisturbed areas).

2. Comparison and evaluation of grazed areas with available actual use records and similar soils, topography, and climatic conditions.
3. Data from research.
4. Comparisons of areas with varying degrees of present grazing use and areas excluded from such use.
5. Historical accounts from photographs or literature where available.

A range site may consist of one or more soil types, phases of soil types, complexes of soil types or phases, undifferentiated groups, or miscellaneous land types. Range sites are also indeterminate in size depending entirely on the production, management unit size, size of the ranch unit involved, and grazing use patterns.

Using the above procedures, a study establishes numerous range sites in the process of completing the soil survey. Vegetative density, composition, and air-dry weights are determined for all soil series described, and these are grouped into range sites based on the above criteria.

Densities and species composition may be determined by using a 100-foot steel tape marked in 10ths of a foot (line intercept method), by using a 9.6 sq. ft. plot (nearly identical to the Bureau's weight-estimate method), and by estimating.

Data are required on as many relic areas, relatively ungrazed areas, protected areas, etc., as possible in an effort to interpret the information needed to establish the potential plant community and production on each of the established range sites.

Each range site is named and described individually in a standard format, as follows (see illustration #2):

1. Site name.
2. Geographic location of the range site.
3. Pertinent features of the climate.
4. Brief topographic description and elevation range.
5. List of soil taxonomic units which characterize the range site.
6. Brief description of the potential native plant community for the site (interpreted from relic areas, etc.).
7. Approximate yield of the potential plant community expressed in lbs./acre of air-dry herbage (interpreted from relic areas, etc.), for both good and poor years.
8. Location of a typical example of the range site.

Condition and Trend Procedures

Range condition and trend are necessarily two separate entities, and the procedures used for each will be explained separately.

Range condition is considered to be the present state of the vegetation in relation to potential conditions for that site. All condition ratings are established for separately identified range sites. The primary purpose for determining range condition is to provide a means of measuring any deterioration or improvement in the plant cover of the site and thus have a basis for predicting the improvement possible. Since condition is only a relative term it must have a standard, which is defined as the kind and amount of native vegetation which the range site is capable of producing. Therefore, range condition is expressed as the degree to which the present site composition (by production weight) has departed from the potential plant community. On the basis of this, four range condition classes are established, as follows:

Condition Class	Percent of Present Composition That is Potential for the Site
Excellent	76-100
Good	51-75
Fair	26-50
Poor	0-25

Since range condition is determined by comparing the present vegetation with the potential vegetation of the plant community, the various range plants are segregated into groups based on their response to grazing use on the specific range site. The categories of plants are defined as decreaser, increaser, and invader plants.

> Decreaser plants are species present in the potential or climax plant community that decrease in relative abundance with continued moderately heavy grazing use.
>
> Increaser plants are generally present in the potential or climax plant community and normally increase in abundance as the decreaser plants decline.
>
> Invader plants are plants that are not members of the potential plant community for the site.

The established range site is utilized to determine a range condition guide for the class of livestock utilizing the site. This is completed at the time the original range site description is prepared and attached to it (see illustration #3). In this study area the range condition guide is prepared for internal use of the SCS only and is not intended for use by other agencies with

management responsibilities in the area. The range site description (illustration #2) is the only data furnished other users of the soil survey. The range condition guide lists the three categories of plants--decreasers, increasers, and invaders--and the key species in each category. The percentage of each increaser plant allowed in the climax or potential plant community is also given. This percentage is based on air-dry weight and not density. Decreasers are not given a percentage rating as they will all be found in the climax or potential plant community, and the entire percentage composition is counted toward the condition rating. Invaders, likewise, have no percentage rating as they are not recognized as being desirable and will not be found in the climax or potential plant community. In conjunction with the above prepared guide to condition, the miminum percent by weight of the decreaser species that must be found in each condition class is given. An estimated range in pounds per acre of total air-dry herbage produced in favorable and unfavorable years, based on plot clippings, estimates, etc., is also given for each condition class.

On the basis of the Range Condition Guide, present and future condition classes will be determined utilizing a prepared form (see illustration #4).

In computing the condition class, each category of plants (decreaser, increaser, and invader) is listed separately. The maximum percentage

by weight normally found in the potential for the plant community, as taken from the range condition guide, is also listed. The percent of composition for each species is recorded and the allowable percent of present composition counted toward potential and condition class is recorded (not to exceed the maximum percent normally found in climax). Thus, the totals of the percent counted toward potential gave a numerical rating which determined the condition class.

The range condition portion of the study requires a very complete understanding of the range site and depends on the proper interpretation of the soil, relic areas studies, etc., to arrive at the proper condition rating.

Range trend is a separate determination to indicate whether the range site is improving or deteriorating. Trend information is necessary to plan required adjustments in management to either improve or maintain the resource. No forms are required to complete the trend information, as trend is merely the additional interpretation based on the range condition of the particular range site and will become apparent over a period of time. Factors to consider in determining the trend of the range site are plant vigor, abundance of seedlings, composition changes, plant residue, and the condition of the soil surface. The relative importance of each of the above varies with differences in climate, soils, vegetation and its relationship to the potential or climax.

Summary and Relationship of Procedures

It is the present policy of the Soil Conservation Service to make one survey to collect the essential information on soils and vegetation and to make interpretations from them. The objectives of a soil survey are to provide a basis upon which to make predictions for the (1) kind, quality, and yields of plants that can be grown on different soils under specific use and management, (2) the effects of longtime use on soils, and (3) engineering performance of soils.

The theory behind the system is that the inherent productive capacity of different areas of rangeland depends primarily on the combined effects of soils and climate peculiar to them. The objectives of range sites is to express these differences in productive capacity. The range site recognizes only those differences in the soils which are great enough to materially influence the production of native vegetation and which can be used in the practical management of the native forage crop. Range sites may thus encompass several different soils and be recognized by distinctive changes in kinds or porportions of plants that compose the potential plant community and differences in total production of vegetation, when composition is essentially the same. Range sites are not recognized by differences in soils or climate unless they result in differences in the potential plant community.

Range condition information is gathered and based on the factors delineated in the range sites and are a part of the actual range site information. Range condition is expressed as the present condition of the vegetation in relation to the potential for the site. Range condition is used as a basis to predict improvement possible.

Range trend is merely a further interpretation of condition, evident with time.

As can be readily seen, the several entities are all incorporated into one system. Soils form the basis for establishing range sites and range sites are the basis upon which condition and trend ratings are made.

III. ANALYSIS OF STUDY

General

When confronted with the necessity of analyzing the Tuscarora Mountain Soil Survey, two definite elements appear to be basic to the study.

(1) The soil survey as it pertains strictly to the interpretation of soils--its physical characteristics, its engineering characteristics, and its naming and location (Soil Classification).

(2) The soil survey as it pertains to the interpretation of vegetative and productive capabilities, both present and potential (Range Site and Condition Classification).

An analysis of the soil survey cannot be made without separating these two phases. The following analysis of soil classification and range site classification attempts to do this.

Soil Classification

Aerial photographs were used in the process of field mapping. Low intensity mapping was accomplished on 2-inch-per-mile aerial photographs, while the high intensity mapping was completed on 8-inch-per-mile photographs.

The area involved in the study (which is very typical of most of Nevada) is dominantly mountainous or hilly rangeland with

contrasting geological materials and ages of land form; thus, the soils have commonly varied considerably within short distances, resulting in many small areas of soil which contrast greatly with each other. Mapping these individual areas is time-consuming and results in a map so detailed it has little use in management of large areas. Therefore, in an effort to combat this problem the soils were grouped into mapping units of either unlike or similar soil individuals. These are termed complexes (a soil association the taxonomic members of which cannot be separated individually in a detailed soil survey) or associations (a group of defined and named taxonomic soil units, regularly geographically associated in a defined proportional pattern). Thus we have a mapping unit that contains two or more contrasting kinds of soil that are usually regularly associated together. However, instead of having a mapping unit composed of all one soil, we have a mapping unit in which the soil associations have varying percentages of two or more kinds of soil. The soils in the association need make up only 80 percent of the mapping unit as delineated, with the remaining 20 percent composed of still additional soils which occur in small amounts and in aggregate make up less than 20 percent of the mapping unit.

The important factor to recognize is that soils put together in an association to make mapping simpler are not put together

because they are similar, but because they are geographically associated. They may be similar or quite unlike one another. Some soils which occur over broad areas as smooth valleys or terraces have been mapped separately as individual units, but are generally in the minority.

Soil mapping units in a low intensity survey are delineated on the photographs much the same as are range types, and they are identified primarily by color shades, natural features, and topography. This results in a fairly accurate soils map as far as exterior boundaries are concerned. The soil or soils within the mapping unit are identified by traversing the area, sampling the soils, and recording the features of the soil profile. If soils change rapidly a large number of examinations must be made. If the soils are extensive and uniform, fewer examinations are necessary. The greatest problem encountered is to define the limits of the intensity of survey. If a low intensity survey is to be accomplished, far less detail is required and consequently the accuracy and conclusions are much more general. Low intensity connotates examining the soils at moderate to wide intervals. As the intensity of the survey increases, accuracy increases, conclusions are more sound, and the time required to accomplish the survey is greatly increased. A major problem confronting this system of survey is a determination of the necessary detail to which rangelands should be subjected.

Soil associations are determined by the examiner on the basis of his judgment concerning the area involved. Thus, the percentages of each soil present in a mapping unit association are arbitrarily determined; i.e., no transects or other sampling devises are run to determine percentage composition.

To simplify mapping, an effort was made to establish mapping units which will repeat themselves whenever the specific soils are encountered.

Several advantages and disadvantages are readily apparent in the following discussion.

The dominant soils in an area are identified and their general locations determined. The end result of a soil survey is to provide a soil map which will show the distribution of soil types or associations of soil types in relation to land surface. Thus a relatively stable basis is laid for making further studies about the capabilities of the soils. By being classified, described, and given names in accordance with the nationwide system of soil classification, information from various areas can be accumulated and empirically interpolated to other areas. This information could be used for initial, general planning purposes in RC&D, Lands, and Construction programs.

Soil series and soil taxonomic units are identifiable. However, when taxonomic units are grouped into mapping units, they become part of a homogeneous unit having no specific location and their identity is lost. Soils are mapped only to the nearest 20% and to only 80% of the total. The other 20% is classified as unnamed inclusions in the mapping unit. This means that an error of 30% is possible in each mapping unit (20% included types plus 10% or one half of the smallest division used). Low intensity surveys, while considered detailed, are of necessity quite general. The areas covered by low intensity surveys were primarily rangelands and were as a matter of course the higher, rougher areas. Topography alone increases the complexity of the low intensive survey many fold over the high intensive survey, yet the economic return is not great enough to allow a more detailed, high intensive survey as on potentially irrigable lands. To increase coverage and decrease the time required to complete the survey, only the dominant or major soils are mapped and identified. Percentages of the soils making up the mapping unit are arbitrarily established. These detract from the detail, use, and accuracy of the survey. With the exception of a modal pit for each soil series, few write-ups were made of the soil study plots. Pit locations are marked on the photographs along with the observer's interpretation of

what soil series is found at specific locations. In this survey, the number of test pits represented less than one per section.

Use of the soil survey data is feasible in initial planning for programs such as road and reservoir construction, lands work, seeding and other treatment practices; however, detailed plans would require much more intensive data than is provided by the soil survey.

The time involved to complete a soil survey of this type is great. Work on the low intensity portion of this survey has been in progress for 3 years and is still not completed. Overall final reviews and rechecks of special areas are necessary. Discussion with local SCS people working on the survey indicates that publication will not be completed for from 2 to 3 years and will even then be subject to revision to obtain more specific data. The total time represented on each survey before basic data is made available is 4 to 7 years.

The cost of producing this soil survey is high. To date there have been 3 men assigned to the survey for 3 years with minor time lost to work on other projects. Basing the costs on an average grade of GS-9, $7030 per annum, the cost per acre thus far for permanent wages alone has been 7 1/3

cents per acre. Vehicle operation averaging 800 miles per vehicle per month at a rate of 6 cents per mile and other costs of the chief of party, SCS area, State, regional, and Washington personnel conducting reviews, correlation work, and clerical help would result in an additional cost of 4 or 5 cents per acre (including wages, per diem and transportation). Collection of additional range site information is required plus the additional costs of writing and publishing the report. On the basis of the above figures, the cost per acre of the low intensity soil survey would be from 14 to 16 cents per acre. To similarly survey the remainder of the BLM administered lands in the Elko District would cost in excess of $1.2 million and would take 30 years to complete. In comparison to this figure, the regular range survey in the Elko District for 1963 completed 888,000 acres in 4 months at a cost of 1.3 cents per acre. The average cost of range surveys for the State of Nevada was 1.7 cents per acre for 1963. The cost figures include temporary and permanent salary costs for both field work and office compilation, per diem, vehicle operation, horse rental, supplies and materials, and other miscellaneous costs directly related to the range survey.

Range Site Classification

Range sites, by definition, are kinds of rangelands that naturally produce either different kinds or amounts of vegetation. On the basis of this, some 38 range sites have been established and described for the survey area with one or more soil types falling into each site. However, only a portion of the soils has been studied to date and these are primarily on areas in good to excellent condition.

The system employed to determine yield on the soils for classification into range sites has been very similar to the BLM's procedures for conducting weight-estimate range surveys. A 9.6 square foot circular plot is used, with 10 plots taken within the study location. Every third plot is clipped and all 10 plots estimated. Weights of the clipped plots are not taken until after all the estimates have been made, then the estimated plots are adjusted on the basis of the deviation of the estimated from the clipped weights. Composition and weights are recorded for each species. Productivity of each study location is expressed in terms of total air-dry herbage per acre, and composition is expressed as the percent of the total herbage weight contributed by each species. Estimates of species composition, density, and total air-dry herbage per acre are also made at each modal (central concept) soil location.

This phase constitutes one of the major problems confronting data collection for the range site classification system. To secure reliable and accurate data, clipping is done only after all major species have completed growth, but before early maturing plants have begun to shatter. By starting clippings on the lower, earlier-maturing sites and extending progressively to the higher, later-maturing sites, studies can be made for approximately 6 weeks. This is a very sound system; however, it greatly reduces the amount of data that can be gathered during a specific year. Since it is impossible in a relatively short time to gather all the data needed for each soil and the various condition classes on each, it is necessary that assumed potential herbage production and condition classes be estimated for the various range sites. This is accomplished by interpolation and extrapolation of data from presently available studies on similar soils.

An analysis of the range site classification system as employed by the SCS in this study area indicates a number of obvious and interesting considerations when projected with BLM objectives and requirements.

First, knowledge of the site in relation to its potential plant community provides a guide to assist in management of the resource. The range site classification system endeavors to furnish this data. Studies of the range sites attempt to provide useful information

concerning the species present in each condition class and at potential for the site. This information would enable a range manager to graphically see the deviation from potential and have a reliable basis upon which to judge management needs and adjustments.

There are certain technical disadvantages involved in the site classification system. Of primary concern is the necessity of using relic areas as the basis for both current and potential production. Accuracy demands the establishment of potential (relic) areas for each soil series studied. Applicable relic areas are not available in the area. Some assumption of relic areas can be inferred from observation of protected or semi-protected areas of the same general quality; however, in the case of this survey, all determinations of potential are empirical and have no basis of observable or measurable data.

The collection of data to accurately portray a range site will require a great many years. Each soil comprising a range site must be studied at several locations in all its condition classes before reliable conclusions on production can be made.

Little or no consideration is given to those less desirable plants which are not normally a part of the climax, although they may be producing the bulk of the forage in the present plant community. No consideration is given to the possibility of artificial revegetation when considering condition and climax. All condition is

predicated on the assumption that the site (if managed properly) will progress to a native climax site. This is true to some extent - particularly in those favored sites most nearly reaching a climax situation at the present time. However, much of the western range area has been abused by wildfire and misuse to the point where there is no seed source of the climax species in the area and although a return to climax can be envisioned, the time element is untenable.

The system presently used by the SCS in the area does not account for differences in plant palatability, preference, or proper use, nor does it take into account the composition of the plant community. They use a rule-of-thumb guide that all palatable plants can be utilized to 50 percent and is termed usable forage. Neither does it consider usability deductions (rock, slope, lack of water, etc.), as these are to be separate adjustments made at the time a grazing plan or system is developed.

No consideration is given to wildlife use other than designating that wildlife use is made on various soils and range sites. Some range sites should be set up strictly for wildlife, and livestock use not considered.

When setting up range sites without soils information, a relatively large area, usually a vegetative type, is set up as a specific site; however, when using soils as a basis for establishing range

sites, the function is complicated. For example, a mapping unit made up of three soil types may all be in the same range site or there may be two or three different range sites. Therefore, if it is impractical to separate soils out as individual taxonomic units, but instead establish associations of soils, it will also be necessary to establish associations of range sites. These associations of range sites to be practical must conform closely to physiography and cover broad areas and may encompass two, four, or more range sites, each making up varying percentages of the association. The other alternative is to have the site association conform to the mapped soil association which will be a smaller area, but still have several range sites involved. Either procedure becomes complicated when endeavoring to apply a condition rating which requires that the exact location of the site on the ground be known, to arrive at a rating.

On the basis of observations made during the study, the total herbage yield on the various range sites is not as closely related to a specific soil or climatic factor as is species composition. The species present in each range site at potential will be the same at all locations, but the percent each species makes up of the total composition may vary greatly between each location. For example, Site A at potential in two different locations may include both bluebunch wheatgrass and Sandburgs bluegrass; however, at one location the plant community may have 40 percent bluebunch

wheatgrass and 20 percent Sandburg bluegrass and at the other location there may be 20 percent bluebunch wheatgrass and 40 percent Sandburg bluegrass. This will have a tremendous effect on the total herbage production and grazing capacity of the two separate locations. Therefore, the inherent fluctuation in production and variation in composition make it impractical to finely define the composition and herbage production of vegetation associated with a given soil taxonomic unit. This requires that the vegetative characteristics of specific soils be expressed as a range of values. The outer limits of this range can be defined only after continued and extensive studies on each soil taxonomic unit.

Range Condition and Trend

Range condition has not been determined during this study other than an estimate of production in the various condition classes as they relate to range sites.

To complete condition studies on the area will require a separate condition survey of the area. It is nearly impossible to conduct a condition survey on the area simultaneously with the soil survey because the soils and range sites must be delineated and the potential determined and described before condition can be ascertained. A specific range site location may have several or all the condition classes represented within it. Range condition can more expeditiously be determined as a separate function from soil surveys and range site classification. This will require that the various

range sites be re-examined in the field and range condition delineations mapped.

Trend information will be available over a period of time as condition studies are completed. The important advantage of the described system of range condition studies is that the condition is reflected as a deviation from the potential for the plant community. This is a direct measuring stick, which is highly significant.

However, the greatest disadvantage with the procedure is that accurate and complete range site data are essential to having reliable condition determinations and will be available only after years of study on the specific sites.

Condition studies will also be complicated when endeavoring to conduct them on areas mapped as soil associations and range site associations. It will require that boundaries of the various range sites within the associations be identified in the field before a condition rating can be made.

Comparison with Occular Reconnaissance Survey

One of the Bureau's most immediate needs is for information to establish initial stocking rates. A comparison was made for this purpose between the range site classification soil survey and the procedures now in use within the BLM. A portion of the soil survey

area coincided with an Occular Reconnaissance Range Survey done in 1963, and was used for the comparison. The table below shows the resultant carrying capacities obtained by following the two methods:

Table 1

Carrying Capacities in Acres per AUM

Range Survey	Range Site Classification	
	High Range	Low Range
7.0	4.7	15.1
7.0	5.9	21.0
7.9	9.4	25.8
4.4	9.4	25.8
4.4	10.7	16.0
6.0	10.7	16.0
11.2	10.7	16.0

Carrying capacity as used in range site classification is in direct relationship with the condition class of the present community. Condition, in turn, is expressed as a percentage of the desired or allowable species now in the plant community which go to make up the theoretical climax community. To determine the range site carrying capacity shown in the table, the condition class was established by using the composition shown in the plot write-ups of the range survey.

The range in carrying capacity shown under the range site classification column represents the variation in production caused by favorable and unfavorable years which is built in to the range site method as used by the SCS. The assignment of a plant community into a rather arbitrary condition class inserts further variability into the system.

IV. SUMMARY AND CONCLUSIONS

The primary purpose of this study was to evaluate and analyze the Soil Conservation Service procedures for inventorying both soil and vegetation simultaneously in the field and to determine their correlation and relationship. An additional purpose was to determine the feasibility and desirability of modifying BLM inventory or study procedures to incorporate soil surveys or to modify soil survey procedures to provide for present and future needs of the BLM.

In summary, the soil survey system, as presently used by the SCS, results in the following relationship of procedures. Soil series are described to identify the individual kinds of soils (illustration no 1). Units of a soil series are known as taxonomic units and are the basic unit of soil classification (illustration 5), while a soil mapping unit (illustration 6) is made up of one or more taxonomic units and inclusions. The inclusions may be other taxonomic units or described land forms (rough-broken land, rock outcrops, etc.). Several kinds of mapping units have been described—(1) soil associations, (2) undifferentiated groups, and (3) a single taxonomic unit. The uses which may be made of the survey are anticipated and the mapping units are grouped according to their potential for each use. One of the basic groupings of soils data is for range

sites (illustration 2). This is a grouping of soils taxonomic units on the basis of similar native plant communities.

The usefulness of basic soils information is quite obvious and the use and management of rangelands will require more basic knowledge of their potential plant communities, particularly as intensification of their use and management progresses. However, the mere gathering of soils data does not provide a "cure-all" for range management. The objectives of soil surveys are to provide a basis upon which to make predictions for the kind, quality, and yields of plants that can be grown on different soils under specific use and management, the effects of long-time use of soils, and engineering performance of soils. Soil surveys are similar to vegetative surveys in that they attempt to identify and map specific kinds of soils in relation to the land surface. The soil survey map is used to make interpretations about the behavior of each kind of soil under defined situations. The important consideration on rangelands is to have sufficient knowledge of the plant communities associated with the various soils to make reliable interpretations concerning their current and potential production.

Few of our rangelands are presently supporting their potential plant communities, thus it is difficult to determine potential,

particularly as the condition of the range declines. The concept of range sites endeavors to express the inherent productive capacity of different kinds of rangeland using soils as a base. (The range site can be compared to the capability unit for cultivated land.) When the potential plant community is not available, a range site can only be recognized on the basis of permanent mappable features which are consistently associated with the potential plant community. Theoretically, by studying reliable relict areas or areas in good to excellent condition found on the various soils, the potential plant community associated with the soil can be determined and range sites established. However, since such areas are rare, it is necessary to establish an assumed potential for many of the range sites. This is done primarily by interpolation and extrapolation of data from presently available areas on similar soils. Therefore, interpretation is possible only if basic data about the soils are available, usually obtained from field and laboratory research, field experiments, experience of users of the soils, and comparisons with similar soils with known potential and production. The more reliable the data on the soils, the more reliable the predictions. The validity of these interpretations regarding the specific soils can be

conclusively proven only through the successful application of the findings to practical management and use of the range areas.

A range condition and trend study based on the established range sites is a means of determining the departure from potential and whether the condition is improving or deteriorating with time. Over a period of time it will also provide a basis for adjusting the original interpretations.

Soil and vegetation data can be gathered simultaneously in the field. However, the time required to complete the soil survey is less than that required to collect reliable vegetation (range site) data. Range sites, for most conclusive results, are dependent on having identified soil taxonomic units; thus, soils must actually be identified prior to the establishment of range sites. Soils identified through a soil survey are relatively static if properly identified and mapped, unless they are changed through physical deterioration. On the other hand, vegetation data to support range site classification must be continually gathered and analyzed over a period of years to arrive at accurate information on the plant communities in potential as well as the various condition classes. This will necessitate that the documentation of data gathered for

specific soil types at various locations, correlate annual and seasonal fluctuations in plant growth and production. These must be carefully correlated to the range of soil characteristics for the soil type, i.e., the site must be at a modal location for the soil or definitely segregated as to its deviation from modal to accurately define the production, vegetative composition and characteristics for the specific soil type.

Range site procedures, though very sound in theory, are not as concrete in actual practice. There is considerable spread within the established range of characteristics of both soils and range sites. Since the criteria for establishing range sites are based on differences in total herbage production or the composition of the plant community, arbitrary breaks in production must be used to separate similar plant communities with differing production. A rule-of-thumb figure is generally used—if total herbage production of two plant communities differs by 25 percent or more they will be placed in different range sites. This phase leaves some serious doubts when research has shown that both herbage yield and species composition of a specific stand of native forage may be expected to vary this much over a period of years or even annually.

The soil series description (illustration 1) defines the central or modal concept of the series. They are used to represent the entire range of characteristics within the soil taxonomic unit. (illustration 2) There are no clear cut, finely differentiating lines between soil series because of the wide range of characteristics generally allowed. This range in classification extends also into the vegetative characteristics, particularly where the site is at much less than potential. Soil classifications are often differentiated by assumptions made from the observation of vegetative characteristics. This is particularly important when considering closely associated series where defining characteristics may be vague.

By using a system of arbitrary association percentages, as is done in this system, the final compilation of acreages in each soil type becomes only an estimate. Combining this information with range site data to determine total production for an area at potential may result in an erroneous figure.

Of major importance in determining whether to use, modify and use, or reject this type of survey is the use to which the final data can be put within the BLM.

A definite need appears to exist in the lands work for greater, more defined soils information. In the areas of preclassification, Master Unit work, land examination, and classification

a detailed survey of this type may give enough soils data to produce general plans or operations information. It could not in its present stage replace field work, nor does it provide adequate information for specific reference for lands case work.

Anticipated uses of soil survey data might also be in areas such as general watershed planning, particularly when tied in with vegetative and hydrologic studies. Soil surveys may provide a general basis for initial planning work in determining the suitability of various soils for construction and treatment practices. Detailed planning, however, will require a much more intensive data accumulation than is provided by the soil surveys. Their value for engineering interpretations is limited and requires detailed additional study of the soil.

Soils and range site information will not enhance the adjudication processes of the Bureau of Land Management because:

a. The procedure is very time-consuming and would not be available for the BLM areas until long after the 1967 fiscal year adjudication deadline.

b. Range site data are no more reliable, if as reliable, to base present production on than the present BLM resource inventory procedures and are far more time-consuming and expensive.

The value of the soil survey in its present form is limited for purposes of management. Correlation between soils and range sites and between range sites, condition, and carrying capacity is too inconclusive as a basis for action. The BLM programs of adjudication, management, planning, establishment of initial stocking rates and potential, and range or allotment appraisal (including all types of studies) requires a degree of definition which is not possible with soil surveys at the present time.

Mapping by associations of soils will require that the users of the soils map return to the field and examine the area to determine the exact location of specific soils. In many instances this can be determined from the vegetation on the area or from physiography; however, other areas will require at least a cursory repeat examination of the soil.

The soil survey and range site procedures of the Soil Conservation Service for use on rangelands are designed to give a range manager a concept of the potential plant community toward which he can manage or the capability of the soil to produce various plants. However, for the immediate purposes of initial stocking rates, range potential, adjudication, and allotment appraisal, the information provided by the soil survey is not sufficiently useful as a

management tool in its present form. Carrying capacities taken from soil survey range site writeups have such a wide range or choice of action that their use represents no sound choice at all. Some procedural steps are governed by "best estimates" rather than on researched phenomena. The cost of detailed soil survey information is high. In addition to the cost of securing the initial soils data and publication of the report, must be added the cost of providing supplemental vegetation data to effectively correlate soils and vegetation.

The soil and range site classification concept of resource inventory, as conducted by the SCS, arrives at the ultimate conclusion that the validity of survey interpretations on rangelands can be finally proven only through their use and management. Future adjustments will be required in range site descriptions as additional data are secured. Initial stocking rates derived from the soil survey, range sites, and condition determinations will require adjustments either up or down based on actual use records, condition and trend data, utilization checks and any other acceptable study methods. Present BLM procedures for resource inventories require the same proof through use. Range surveys provide an initial stocking rate which will also be adjusted in the future on the basis of actual use records, condition and trend data, utilization checks, permanent transects and any

other satisfactory study methods. Thus, both procedures arrive at the same conclusion. Procedures presently used by the BLM are less costly and more rapidly completed, however, and for this reason appear more desirable.

With modification of the soil survey procedures and intensive research to close the gap in correlation of soils, range sites, condition, and carrying capacity, greater use could be made of soil survey information.

Following are advantages and disadvantages, most noted by the writers of this report, in the soil survey when considering its use for BLM needs.

Advantages

1. Soils when properly mapped and classified are a static base upon which to make future decisions.
2. A theoretical concept of potential is established.
3. The relation of condition to a percentage of the potential appears to be a sound criteria for establishing condition.
4. There appears to be some correlation between vegetation and the soils supporting such vegetation.
5. Basic soils information would be useful in preliminary planning of such activities as lands work, RC&D and construction programs.

6. A completed soil survey provides a base on which to apply the tempering experience gained in the use and management of the resource.

7. Range site classifications are a sound basis for establishing basic management information provided enough information and knowledge is available to establish their reliability.

Disadvantages

1. There is not enough detail in mapping and classification to provide adequate information considering the normal complexity of rangelands.

2. The cost of low intensity soil surveys is at the present time prohibitive for the benefits derived when applied to rangelands.

3. The time involved from initiation to publication of soil surveys is inconsistent with BLM needs.

4. Sufficient correlation is not established to set up management goals based on potential or climax from range site classification. The majority of range sites in this study were established without conclusive field investigation.

5. Soils are mapped only to the nearest 20 percent and to 80 percent of the total. Soil series are not locatable in the mapping unit.

6. Planning for specific projects would require a detailed recheck of areas involved.

7. The establishment of range site classification is predicated on the study of relict areas for each soil series. These relict areas are not generally available for study.

8. Condition ratings consider only those plants which would normally appear in the climax stand and only to those proportions in which they would normally appear.

9. Little or no consideration is given to less desirable plants which may now be producing the bulk of the forage, but which are not allowed in the climax community.

10. No consideration is given to artificial revegetation when determining potential.

11. A range survey such as is now used within the BLM would still be required to establish condition classes for production ratings.

12. All potential and condition ratings assume a return to climax through proper management. In poorer condition, many of the sites have no seed source of climax species, and thus do not have the capability of returning to climax.

13. Range site data from soils surveys do not meet the BLM's needs for purposes of initial stocking rates, range potential, adjudication, and allotting.

14. Carrying capacities from range site write-ups have such a wide range or choice of action that their use represents no real choice at all.

15. Productivity is expressed in terms of total air-dry herbage yield per acre. No consideration is given to palatability or proper use. Carrying capacity is based on a "take half, leave half" concept.

16. Consideration is not given to other classes of livestock nor to wildlife when determining carrying capacity.

17. Consideration is not given to variance in productivity, palatability nor availability due to seasons of use.

18. The basic assumption, in the range site classification system, that the same soil at various locations will have the same herbage yield when in the same condition is not reliable. It appears that the only constant factor is the plant species present. The percent composition by species and the herbage production will vary widely between locations.

V. RECOMMENDATIONS

During the preceding two and one-half years, the writers of this report had the opportunity to closely study, observe, and participate in a cooperative standard soil survey conducted in accordance with SCS procedures.

Based upon these findings and the conclusions presented, we make the following recommendations:

(1) That the Bureau of Land Management should not enter into soil surveys on a "crash-program" basis, but rather should endeavor to develop a system which fits BLM requirements and which will be designed to facilitate the proposed BLM system of range or allotment appraisal.

(2) That the BLM give priority to the development of a range or allotment appraisal system. It is imperative that the BLM continue and intensify the basic management on public lands with presently available funds and personnel. The priority factor at this point is to manage the lands and insure that they have an improving trend of condition when they are in fair or poorer condition, and to maintain or improve the high condition ranges.

(3) That the BLM establish through further study and/or research the degree and amount of soil data necessary

for its proper function. Also required will be further data on the basic correlations between soils and vegetation to determine the degree of correlation and possible identification of key indicator plant species.

(4) That the BLM develop a procedure for gathering soils data consistent with and tailored to BLM needs based on the results of the three pilot studies and item (3) above.

(5) That any soil survey procedures established be combined, in a logical sequence, with compatable programs such as allotment or range appraisal. Interpretations of soils data gathered through procedures established by the BLM be based on these procedures rather than range site classification.

(6) That SCS procedures for range site classification not be adopted for BLM use.

(7) That the BLM soil survey procedures be developed to facilitate BLM operations and not necessarily be required to meet SCS standards for the nationwide system of soil classification and requirements of the National Cooperative Soil Survey. They should, however, be usable as a basis for future intensification to meet SCS requirements if and when it may become necessary or desirable.

(8) That relatively detailed soil studies be made of sites destined for intensive land treatment practices such as, reseeding, contours, furrowing, pitting, brush control, etc.

(9) That the BLM expand and employ additional soils personnel to complete soils work on the public lands for the following reasons:

(a) The BLM, as one of the largest range managers, should have a completely integrated organization to meet the requirements of its resource management responsibilities.

(b) Employing Bureau soils personnel would result in more efficient utilization of manpower to meet imposed deadlines and enable assignment of priorities in conformance with overall Bureau management objectives.

(c) Bureau-employed soils personnel would be working strictly with rangelands and a soil program should be tailored to BLM needs, rather than being an offshoot of a soil survey program directed primarily toward irrigable or cultivated lands, and the procedures of which vary between different areas of the country.

(d) Data furnished by BLM soils personnel would be available for immediate use in resource management, whereas data furnished by SCS soil surveys would not normally be available until the survey was completed and the report prepared.

(e) The BLM has the responsibility for conducting a complete resource management program on the public lands and if soils are considered necessary to fully carry out this responsibility this program should be provided for in the organization.

(f) Bureau-employed soils personnel will be working together with BLM technicians presently employed in resource management and who are closely associated with the resources. These technicians are undoubtedly the best qualified to know the problems and requirements of our western ranges. BLM technicians who have been responsible for the selection and completion of reseeding, spraying, brush control, management, etc., on thousands of acres of public lands are, beyond a doubt, the best qualified and experienced personnel to make interpretations and develop data to supplement soils information on rangelands.

(g) The Bureau can be assured of a completely coordinated and efficiently organized resource management program if existing technicians are supplemented with soils technicians, both with a common goal, and utilizing the vast experience of present BLM technicians in resource management.

(h) The above recommendation does not preclude the conduct of cooperative soil surveys with the SCS, or other agencies, particularly in "checkerboard" land areas where other agencies have a direct interest.

In conclusion, the crux of the situation is that soils data is useful as another basic tool to be used, when available, in resource management; however, its availability will not lessen the need for other types of data presently being compiled and used in resource management, nor will the resource management program be ineffective if the soils data is not available.

VI. APPENDIX

Illustration No. 1	Chicken Creek Series Description
Illustration No. 2	Upland Clay (NV-1-11) - Range Site Description
Illustration No. 3	Terrace Claypan - Range Condition Guide for Cattle NV-1-11
Illustration No. 4	Technician Guide to Range Sites and Condition Classes
Illustration No. 5	Chicken Creek Series - Taxonomic Unit Description
Illustration No. 6	Mapping Unit Description

Chicken Creek Series

The Chicken Creek series is shallow, very cobbly, fine textured soils that are formed from the underlying basalt and rhyolite or tuff. They are moderately well drained and form on moderately steep to steep rolling uplands. The surface has many cobbles and stones. The present native vegetation is dominantly low sagebrush, cheatgrass and various annual forbs.

The surface layer is a light brownish gray, slightly hard cobbly loam, generally about 5 inches in thickness. The subsoil is a light brownish gray, cobbly clay that extends to an average depth of 14 inches. Below the subsoil is fractured basic igneous rocks with some clay forming in the cracks.

Chicken Creek soils are used for grazing lands.

Chicken Creek cobbly loam (Raa).
This soil ranges in slope from 16 to 31 per cent. It occurs mostly on the slopes of rolling uplands. This soil is associated with the Rand, Taylor and Raine series.

Representative profile:
0 to 5 inches, light brownish gray cobbly loam, granular structure, slightly hard when dry, friable when moist, neutral.

5 to 14 inches, light brownish gray cobbly clay, prismatic structure, very hard when dry, firm when moist, slightly acid.

14 inches plus, fractured bedrock with some clay forming in crevaces and on rock faces.

The surface layer is generally 5 inches in thickness, but in some places it is less. 10 to 15 per cent of the surface is covered by stones and cobbles.

This soil is very slowly permeable and the roots extend to the bedrock. The available water holding capacity is 1.5 to 3.0 inches and the fertility is low. The runoff is medium and the erosion hazard is slight. The soil is classed as VIIs and is capable of producing a potential native plant community dominated by low sagebrush, bluebunch wheatgrass and Sandberg bluegrass (NV-1-17). This soil is unsuitable as a range reseeding site.

UPLAND CLAY (NV-1-11) - RANGE SITE DESCRIPTION

Location: Upland terrace, foothills and intermediate mountains slopes at elevations of 5,500 to 6,500 feet. Slopes range from 2 to 51 percent.

Climate: Precipitation averages 9 to 12 inches annually. Normal growing season April 15 - July 1.

Soils: Surface soils range in color from light grownish gray to grayish brown silt loams, clay loams, cobbly gravelly loams and cobbly clay loams, and range in thickness from 4 to 8 inches. The soils are shallow to moderately deep over hardpan and bedrock, are well drained and slowly permeable. These kinds of heavy textured soils have an impeding affect on vegetation that is not too well understood at this time.

Soil Taxonomic Units in this Site:

Chicken Creek cobbly gravelly loam, 16-31% slopes
Chicken Creek cobbly gravelly loam, 31-51% slopes
Donna loam, 2-8% slopes
Pie Creek loam, 16-31% slopes
Pie Creek cobbly clay loam, 16-31% slopes

Native Vegetation: Major plant composition by weight at potential:

Decreasers		Increasers	
bluebunch wheatgrass	15-20%	Webber ricegrass	1-5 %
Thurber needlegrass	5-15%	bottlebrush squirreltail	10-15%
Nevada bluegrass	5-10%	Sandberg bluegrass	5-10%
		narrowleaf aplopappus	0-5 %
		phlox	0-5 %
		low sagebrush	20-30%

Plants dominating the site in poor condition are Sandberg bluegrass, bottlebrush squirreltail, low sagebrush, narrowleaf aplopappus and rocky mountain aster.

Total annual air dry herbage yield can vary from 500 to 850 pounds per acre with soils and topography in favorable years and two-thirds of the above figures in unfavorable years. The percent herbage ground cover ranges from 8 to 12.

Location of Typical Site: One-half mile south of Yellow Spring in Hadley allotment - Cottonwood-Maggie Creek drainage.

TERRACE CLAYPAN

Range Condition Guide for Cattle NV-1-11

Decreasers	Increasers	Per-cent	Invaders
Webber ricegrass	Sandberg bluegrass	12	Cheatgrass
Squirreltail	Phlox	3	Annual weeds
Thurber needlegrass	Crag aster	3	
Bluebunch wheatgrass	Hairy balsamroot	3	
Nevada bluegrass	Eriogonum	1	
Agoseris	Lomatium	2	
Mertensia	Penstemon	1	
	Aplopappus	3	
	Larkspur	1	
	Antenaria	3	
	Other perennial forbs	3	
	Low sagebrush	35	
	Alkali sagebrush	35	
	Douglas rabbitbrush	1	

Range Condition Guide NV-1-11

	Excellent	Good	Fair	Poor
Per cent climax	100-76	75-51	50-26	25-0
Estimated range in pounds per acre of usable air dry forage produced in favorable and unfavorable years, based on preliminary clippings for use in determining initial stocking rates.				
Favorable years	125-115	115-75	75-40	40
Unfavorable years	65-50	50-35	35-25	25
Minimum percentage of decreasers	40	25	15	

TECHNICIANS GUIDE TO RANGE SITES
AND CONDITION CLASSES

BOWIE WORK UNIT

Key Climax Plants and Others that Invade with Overgrazing

Key Climax Plants	Percent Allowable by Sites *							Invading Plants
	1	2	3	4	5	6	7	
Little bluestem	-	-	-	-	-	-	-	All annuals
Big bluestem	-	-	-	-	-	-	-	Windmillgrasses
Indiangrass	-	-	-	-	-	-	-	Hairy Tridens
Switchgrass	-	-	-	-	-	-	-	Texas grama
Canada wildrye	-	-	-	-	-	-	-	Tumblegrass
Western wheatgrass			15					Red grama
Sideoats grama	20	10	10	-	25	5	INV	Silver bluestem
Blue grama		5	5	-	10		INV	Splitbeard bluestem
Hairy grama	10	5	INV	5	INV	5	INV	Weak lovegrasses
Texas wintergrass	5	5	5	5	5	5		Low panicums
Buffalograss	INV	5	INV	15	5	INV	INV	Low paspalums
White tridens		INV	INV	5	INV	INV		Sand dropseed
Vine-mesquite	INV	5	5	15	5	5		Threeawns
Tail dropseeds	10	10	10	-	15	10	5	Western ragweed
Purpletop	-	-	10		-	10	15	Mesquite
Sand lovegrass	-	-	-	-	-	-	-	Opuntia
Woody plants	5	5	10	INV	INV	10	10	
Total percent Increasers in Climax	30	30	25	40	25	30	20	

Range Condition	Safe Starting Stocking Rates by Sites - Ac/Av.							Percent Original Vegetation
Excellent	25	13	8	16	10	13	15	76 - 100
Good	35	17	10	22	14	17	22	51 - 75
Fair	55	23	16	34	21	23	32	26 - 50
Poor	55+	38	25	52	35	38	45	0 - 25

*Site Description (Site Name, Soil Units and Dominant Soil Series or Types)

1. Sandstone Hills RP: 25c (inclusions of 19c and 20c) Darnell series
2. Sandy Loam RP: 6, 7 (minor inclusions of 19c, 20c) Zaneis fine sandy loam
3. Bottomland RP, CT: 8, 9 (minor inclusions of 4) Gowen fine sandy loam
4. Tightland RP: 1, 5 (inclusions of 2 and overwash phases of 3 and 4) Kirkland silty clay
5. Loamy Prairie RP: 6, 7 (minor inclusions of 19c, 20c) Chickasha fine sandy loam
6. Sandy Upland CT: 6, 7 Windthorst and Stephenville fine sandy loam
7. Deep Sand CT: 11, L11, 12, L12 Stephenville and Nimrod loamy fine sand

Legend:

Blank = Not important

- = Decreaser; all allowed

5, 10, 35c. = Increaser; percent found in climax

INV = Invader on the site

ILLUSTRATION NO. 5

Chicken Creek Series - Toxonomi Unit Description

The Chicken Creek series are shallow, very gravelly, fine textured soils that are formed from the underlying basalt, rhyolite or tuff. They are well drained and occur on moderately steep rolling uplands in the higher elevations throughout the area. The surface has many cobbles and stones. The present native vegetation is dominantly low sage, cheatgrass, and various annual forbs.

The surface layer is a grayish brown, slightly hard, cobbly gravelly loam, generally about 8 inches in thickness. The subsoil is a brown, gravelly clay that extends to an average depth of 17 inches. Below the subsoil is fractured basic igneous rocks with some clay forming in the cracks.

Chicken Creek soils are used for grazing lands.

Chicken Creek cobbly gravelly loam, 16 - 31 percent slopes. (Raa).

This soil occurs on the hilly uplands in all the higher mountain areas.

Mapping Unit Description

Chicken Creek cobbly gravelly loam - Pie Creek cobbly clay loam-Rand stony loam, 16 - 31% slopes (40-20-20) Raa-Rvb-Rkc

This mapping unit is fairly extensive over the survey area above elevations of 5,500 feet, and occurs on basic igneous parent material. It is on moderately steep rolling uplands and consists of 40% Chicken Creek cobbly gravelly loam, 20% Pie Creek cobbly clay loam; both of these units support a stand of low sagebrush and grass and 20% Rand stony loam supporting a stand of big sagebrush grass.

Inclusions in this mapping unit consists of 15% Rand gravelly loam on steep slopes.

This mapping unit is used for rangeland and upland game. It is unsuited for mechanical reseeding because of the cobbles and stones on the surface.

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